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AN ASSESSMENT OF AQUATIC RESOURCES IN THE IDOT FAP 301 (U. S. ROUTE 20) PROJECT AREA, JO DAVIESS AND STEPHENSON COUNTIES, ILLINOIS: SURVEYS FOR FISHES, UNIONID MUSSELS, OTHER AQUATIC MACROINVERTEBRATES, AQUATIC MACROPHYTES, AND WATER QUALITY MONITORING

ADDENDUM # 1 (SNIPE HOLLOW) AND ADDENDUM # 2 JO DAVIESS COUNTY

Center for Biodiversity Technical Report 1996(20)

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Addendum # 1 (Snipe Hollow) and Addendum # 2, Jo Daviess County

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Center for Biodiversity, Illinois Natural History Survey

INTRODUCTION

At the request of the Illinois Department of Transportation (IDOT), Springfield, an assessment of aquatic resources occurring in the major streams in the IDOT FAP 301 (U. S. Route 20) alignments in Jo Daviess and Stephenson counties, Illinois, was conducted during 1993 and 1994. In addition, field and laboratory analyses for water quality were performed on samples collected during our surveys for aquatic fauna and flora. Surveys for aquatic resources were conducted at 19 stream sites in the project area. These included sites on the Galena River, Smallpox Creek, Hughlett Branch, Furnace Creek, Irish Hollow Creek, Wolf Creek, Apple River, Rush Creek, Rindesbacher Creek, Yellow Creek, tributaries of several of these streams, and a tributary of the Pecatonica River. Surveys were conducted in June, August, and September of 1993, and in January, April, and June of 1994. Analyses for water quality were performed on samples taken at the time of biological surveys at each of the streams. The results of those surveys were documented in a report submitted to IDOT in 1995 (Wetzel et al. 1995).

Subsequent to submission of that report, Addendum #1 to the proposed IDOT FAP 301 (U.S. Route 20) project was received (Further Studies Transmittal request from Barb Traeger of IDOT to Chris Phillips, INHS, dated 3 April 1995). The project corridor for Addendum #1 is commonly called Snipe Hollow; henceforth this alignment will be referred to in this report as the Addendum #1 corridor. References in this report to the FAP 301 project or project area shall imply the overall alignment corridor, from Freeport in Stephenson County to an area northwest of Galena in Jo Daviess County (previously discussed in Wetzel et al. 1995). On 9 November 1995, a Further Studies Transmittal Request to survey aquatic resources within an Addendum #2 project corridor was received from Barb Traeger of IDOT. No surveys for aquatic resources were conducted within the proposed Addendum #2 corridor, however, because no aquatic habitats occur there.

Several factors were considered when aquatic sampling sites were selected within the Addendum #1 corridor. Emphasis was placed on diversity of habitats within any single site. The presumption was that diverse habitats will support the most diverse communities. Environmental factors such as substrate particle size and type, stream width and depth, current velocity, and vegetation were considered.

Nomenclature for fishes discussed in this report follow Mayden et al. (1992) and Robins et al. (1991), except that subspecies are not recognized. Nomenclature for unionid mussels discussed in this report follows Cummings and Mayer (1992), except that subspecies are not recognized. Nomenclature for other aquatic macroinvertebrates and aquatic macrophytes discussed in this report follow the most current information for each group published in the scientific literature.

The current status of endangered and threatened species of fishes, mussels, other aquatic macroinvertebrates, and aquatic macrophytes discussed in this report are taken from one or more of the following publications: Herkert (1991, 1992, 1994), Illinois Endangered Species Protection Board (IESPB) (1994), or U.S. Department of Interior, Fish and Wildlife Service (USDI) (1993, 1994, 1996).

PROJECT LOCATION

The proposed Addendum #1 corridor for the FAP 301 project presently under consideration by IDOT extends northward from an area just west of Elizabeth, bypassing Galena Territory on the east and then the north side, then extending west to Illinois Route 84 northwest of Galena, all in Jo Daviess County, Illinois. This proposed corridor is encompassed by bold hyphens (exclusive of the central 'diamond-shaped area) on Figure 1. The five aquatic sampling sites surveyed by INHS personnel during 1995 for the presence of fishes, mussels, other aquatic macroinvertebrates, aquatic macrophytes, and sampled for water quality also are noted on Figure 1; legal localities for these five aquatic sampling sites are provided in Table 1.

HABITAT CHARACTERIZATION

STREAM SYSTEMS

Stream order in this text is based upon the Horton-Strahler classification (Horton 1945; Strahler 1954, 1957). The watershed information included below was taken from Brigham (1977, 1978).

Galena River. The Galena River drains approximately 16,320 hectares (40,327 acres) of watershed in Jo Daviess County in Illinois through a narrow, flat-bottomed valley. Upstream tributaries originate in Grant and Lafayette counties in Wisconsin. The Galena River drains dissected terrace and upland landscapes northeast of Galena. The longest tributary of the Galena River has a gradient of 2.4 m km^{-1} over a stream length of 59.21 km. The Galena River is an order 5 stream at its confluence with Harris Slough, through which it enters the Mississippi River 4.5 km south of Galena. Several order 2 tributaries (Bull Branch, Ellis Branch, and Scrabble Branch) and order 3 tributaries (Coon Creek, East Fork, and Hughlett Branch) are included in the Galena River watershed. Order 4 streams include the Galena River at the point where it enters Illinois, Kelsey Branch, and Shullsburg Branch. Aquatic sampling Sites 1, 2, and 3 (Wetzel et al. 1995) and 1A (this report) are located in this watershed.

Smallpox Creek. The Smallpox Creek watershed includes approximately 6,990 hectares (17,273 acres), all in Jo Daviess County. Smallpox Creek joins the Mississippi River 8 km south of Galena. The upper watershed of Smallpox Creek drains a primarily terrace landscape, with highly dissected upstream reaches. Smallpox Creek reaches an order 4 stream near Guilford, where it leaves the upland landscape, and remains an order 4 stream throughout its flow through a narrow, flat-bottomed valley to its confluence with the Mississippi River. Mean gradients of the tributaries from the terraces are mostly less than 30 m km^{-1}, while those from the uplands are close to 50 m km^{-1}. Smallpox Creek has an overall gradient of only 6.3 m km^{-1} over a stream length of 21.64 km. Lake Galena, approximately 93.1 hectares (230 acres) in area, is the only impoundment of Smallpox Creek. Aquatic sampling Sites 4 and 5 (Wetzel et al. 1995) and 2A and 3A (this report) are located in this watershed.

Irish Hollow Creek. Irish Hollow Creek west of Elizabeth is an order 4 stream at its confluence with the Apple River. Aquatic sampling Sites 10 and 11 (Wetzel et al. 1995) and 4A (this report) are located in this watershed.

Apple River. The Apple River originates in Lafayette County in Wisconsin, entering Illinois 2 km NW of the town of Apple River. Its watershed is located principally in Jo Daviess County, and also drains portions of Carroll, and Whiteside counties. The Apple River watershed drains approximately 60,610 hectares (149,771 acres) in Illinois, joining the Mississippi River 11.5 km northwest of Savanna in Carroll County. The principal tributaries of the Apple River include the North and South Forks of the Apple River, Mill Creek, Hell's Branch, Furnace Creek, Irish Hollow Creek, and several other named tributaries.

Figure 1. Locations of sampling sites in Jo Daviess County, Illinois, where surveys for fishes, unionid mussels, other aquatic macroinvertebrates, aquatic macrophytes, and water quality were conducted by Illinois Natural History Survey personnel during June 1995. These sites are located in or adjacent to the FAP 301 (U. S. Route 20) Addendum #1 (Snipe Hollow) project corridor under consideration by the Illinois Department of Transportation. The shaded area represents the existing U.S. Route 20 corridor; the area encompassed by bold hyphens (exclusive of the central 'diamond-shaped' area) represents the Addendum #1 project area. Doubled circles represent aquatic sampling sites. Sites 1 through 19 were surveyed during 1993 and 1994; the results of those surveys are discussed in Wetzel et al. (1995) and summarized in this report. The results of our surveys of Sites 1A through 5A are discussed in this report. All sites noted on this map are referred to by respective number in the text of this report. Scale - 1:240,000; 1" = 3.8 miles (6.1 kilometers).

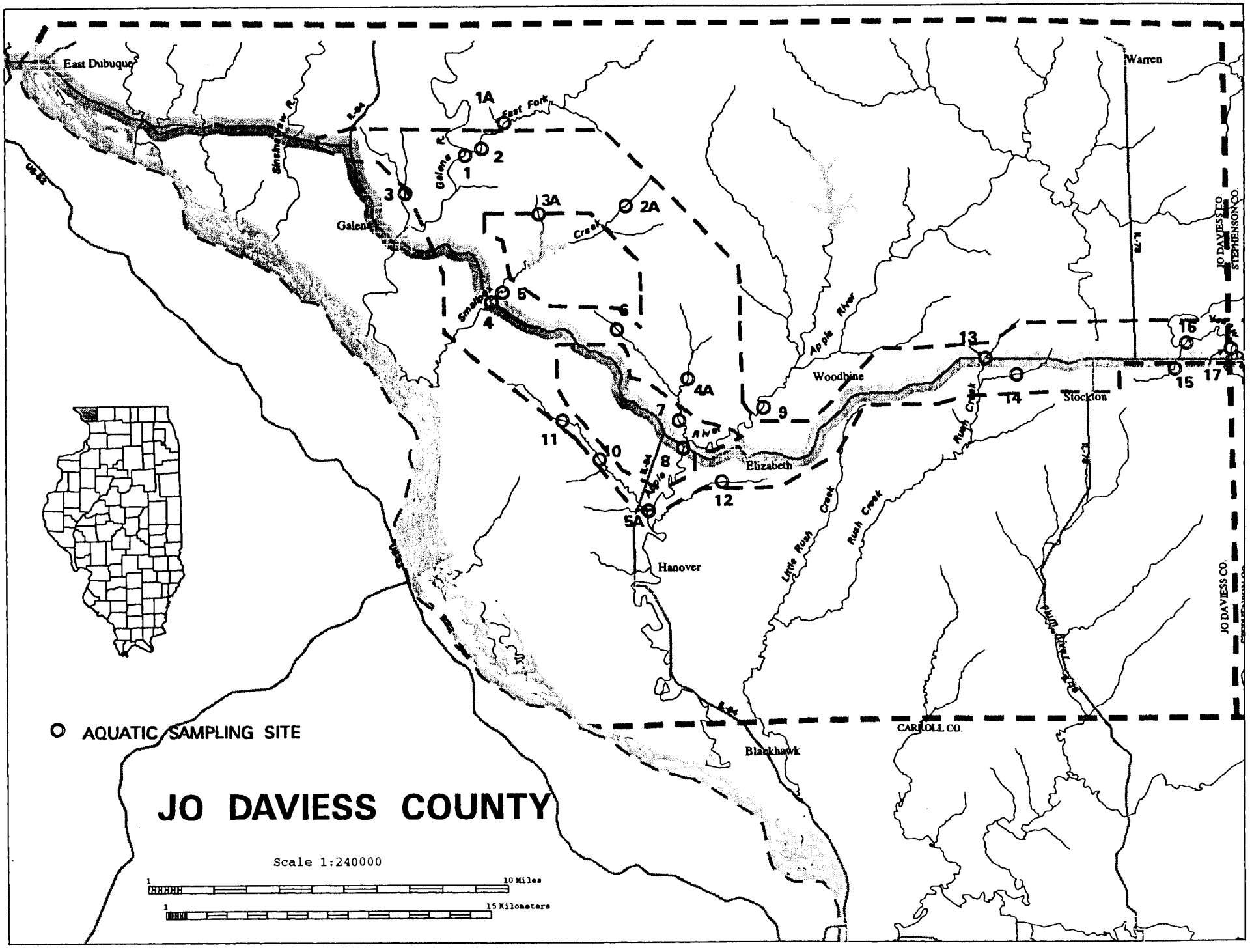
East Dubuque
Galena
Warren
Woodbine
Stockton
Elizabeth
Hanover
Blackhawk
Galena R.
East Fork
Creek
Apple River
Rush Creek
Little Rush Creek
Smelser
JO DAVIESS CO.
STEPHENSON CO.
CARROLL CO.
1A
2A
3A
4A
5A
AQUATIC SAMPLING SITE
JO DAVIESS COUNTY
Scale 1:240000
10 Miles
15 Kilometers

Table 1. Legal locations of aquatic sampling sites in Jo Daviess County, Illinois, where surveys for fishes, mussels, other aquatic macroinvertebrates, aquatic macrophytes, and water quality were conducted by Illinois Natural History Survey personnel in June 1995. These sites are located in the IDOT FAP 301 (U.S. Route 20) Addendum #1 project corridor. All locality information is taken from United States Geological Survey topographic quadrangle maps. Unless otherwise noted, all Universal Transverse Mercator System (U.T.M.) coordinates are to the center of the project site noted in the description.

Site 1A. East Fork Galena River, 1.1 mi (1.65 km) WSW (258°) Council Hill Station, just north of W Kelly Road (gravel road) culvert under railroad alignment (or, 5.5 mi / 8.6 km WSW Scales Mound [center of town, where main road crosses railroad tracks]). 4th Principal Meridian: Township 29 North, Range 1 East, SE/4, SE/4, NW/4, SW/4, Section 36. U.T.M. coordinates: Zone 15, 717190m East, 4704530m North (coordinates to center of bridge). Elevation (water): 665' MSL. Scales Mound West, Ill. (7.5' series, 1968 edition, photorevised 1975) U.S.G.S topographic quadrangle map. [Surveys for fishes and unionid mussels conducted at a site approximately 1 mile downstream - T. 28 North, R. 1 East, NE/4, NE/4, NW/4, Section 2]

Site 2A. Smallpox Creek, 4.05 mi (6.5 km) SSW (212°) Scales Mound [center of town, where main road crosses railroad tracks]), at Rawlins Road bridge / culvert. 4th Principal Meridian: Township 28 North, Range 2 East, W/2, NW/4, SW/4, NE/4, Section 16. Universal Transverse Mercator System coordinates: Zone 15, 722860m East, 4700400m North (coordinates to center of bridge). Elevation (water): 785' MSL. Scales Mound West, Ill. (7.5' series, 1968 edition, photorevised 1975) U.S.G.S topographic quadrangle map.

Site 3A. Unnamed tributary to Smallpox Creek, 3.15 mi (5.1 km) S (184°) Council Hill Station, at W Guilford Road bridge / culvert. 4th Principal Meridian: Township 28 North, Range 1 East, NE/4, NE/4, NE/4, SE/4, Section 13. Universal Transverse Mercator System coordinates: Zone 15, 718600m East, 4699920m North (coordinates to center of bridge). Elevation (water): 740' MSL. Scales Mound West, Ill. (7.5' series, 1968 edition, photorevised 1975) U.S.G.S topographic quadrangle map.

Site 4A. Snipe Hollow Creek, 6.6 mi (10.6 km) NNE (17°) Hanover (to BM 630') [or, 2.6 mi / 4.2 km) NW (320°) Elizabeth (center of town)]. 4th Principal Meridian: Township 27 North, Range 2 East, N/2, NW/4, NE/4, SW/4, Section 11. Universal Transverse Mercator System coordinates: Zone 15, 726320m East, 4691980m North (U.T.M. coordinates to center of bridge). Elevation (water): 656' MSL. Hanover, ILL. (7.5' series, 1968 edition, photoinspected 1975) U.S.G.S topographic quadrangle map.

Site 5A. Apple River, 2.6 mi (4.2 km) NNE (12°) Hanover, at old C&NW railroad alignment crossing (bridge removed long ago). 4th Principal Meridian: Township 27 North, Range 2 East, NE/4, SW/4, NW/4, Section 34. Universal Transverse Mercator System coordinates: Zone 15, 724850m East, 4685800m North (U.T.M. coordinates to center of old railroad alignment). Elevation (water): 615' MSL. Hanover, ILL. (7.5' series, 1968 edition, photoinspected 1975) U.S.G.S topographic quadrangle map. [Surveys for aquatic macroinvertebrates (other than mussels) and sampling for water quality were not conducted at this site.]

Before the Altonian advance of the Wisconsinan glacial stage, the Apple River drained south, along the valley of the South Fork of the Apple River, past what now is Stockton through the valley of Yellow Creek into the Pecatonica River south of what is now Freeport. During the Altonian advance, the South Fork became dammed near what is now Stockton. The impounded water eventually cut through this low divide in an area southwest of what is now Apple River Canyon State Park. The South Fork of the Apple River was reversed in its direction, now flowing northwest. The Apple River and its tributaries drain a highly dissected upland. The river meanders across the Mississippi River floodplain for a few kilometers before its confluence; the middle reaches of the river, to a point about 5 km northeast of Elizabeth, flow through a moderately broad floodplain. Much of the course of the Apple River upstream of this point flows through a narrow valley, with steep bluffs or bedrock cliffs rising as high as 85 m above the valley floor. The longest tributary of the Apple River has an overall gradient of 2.3 m km^{-1}, yet numerous order 1 tributaries flow from adjacent uplands with mean gradients of nearly 80 m km^{-1}. The Apple River is an order 6 stream at its confluence with the Mississippi River. Apple Canyon Lake, approximately 165 hectares (408 acres) in area, is located on the central reach of Hell's Branch, and is the only impoundment within the Apple River drainage. Aquatic sampling Sites 8 and 9 (Wetzel et al. 1995) and 5A (this report) are located on the Apple River.

Site Descriptions of Habitats Within the Addendum #1 Project Corridor Surveyed for Aquatic Resources

Site 1A. The East Fork of the Galena River just north of W Kelly Road railroad (WSW Council Hill Station) was surveyed for aquatic macroinvertebrates, macrophytes, and water quality on 21 June 1995. Sampling was conducted in a 75 m reach of the stream. The width of the East Fork of the Galena River at this site ranged from 7 to 10 m; The majority of this reach was comprised of a cobble and gravel riffle area with small areas of sand; depth in cobble and riffle runs ranged from 0.05 to 0. 3 m. Occasional pools also were present, and were more common downstream of this long cobble and riffle area; depth in the pools ranged from 0.5 to 1.0 m. Substrate in a side pool and a small side channel consisted of mud, clay, and sand. Riparian vegetation hung down into the stream, particularly on the east side. Turbidity was low. This reach of the river flows through fallow fields and lightly wooded areas. Surrounding land use is primarily agricultural. Surveys for fishes and mussels were conducted on 28 June 1995.

Site 2A. Smallpox Creek at the Rawlins Road bridge culvert (SSW of Scales Mound) was surveyed for aquatic macroinvertebrates, macrophytes, and water quality on 21 June 1995. Sampling was conducted from 35 m upstream to 15 m downstream of the bridge. A small tributary entered from the north, approximately 5 m downstream of the bridge. Pools were present both upstream, downstream, and under the bridge (width 5 to 6 m). A reach of several small riffles occurred from 10 to 25 m upstream (width 1 to 2 m) from the bridge; the stream then widened to 2 to 3 m upstream of the riffle area. Downstream of the pool at the bridge, stream width varied from 1 to 2 m. Depth at this site varied from 0.05 m in the riffle areas to 0.13 m in the pool areas. Substrate throughout most of the reach sampled was gravel and sand with some cobble and silt. Turbidity was moderate. Streambanks upstream of the bridge sloped gradually to the water. Cattle were present both upstream and downstream; land use was pasture. Surveys for fishes and mussels were conducted on 28 June 1995.

Site 3A. An unnamed tributary of Smallpox Creek at West Guilford Road bridge culvert (just west of its "T" intersection with Neminer Road, south of Council Hill Station), was surveyed for aquatic macroinvertebrates, macrophytes, and water quality on 22 June 1995. Sampling was conducted from 10 m upstream to 35 m downstream of the bridge culvert. A pool (7 m wide, 0.5 to 0.8 m deep) occurred immediately downstream of the road culvert. Downstream of the pool, this tributary became a series of short runs and riffles, 1 to 1.5 m wide and 0.09 m deep. Substrate of the pool consisted of mud, sand, and chunks of gravel and concrete. Substrate in the

downstream riffles and pools consisted of cobble, gravel, and sand, with areas of mud and silt. The corrugated bridge culvert under Guilford road provided habitat for many adult caddisflies. The tributary upstream of the bridge culvert was 1 -2 m wide; depth was 0.05 to 0.10 m. Substrate upstream of the culvert was primarily gravel, with some sand and detritus. The surrounding land use consisted of a wooded area upstream and a pasture downstream. Surveys for fishes and mussels were conducted on 27 June 1995.

Site 4A. Snipe Hollow Creek at the Snipe Hollow Road bridge (NNE Hanover) was surveyed for aquatic macroinvertebrates, macrophytes, and water quality on 22 June 1995. Sampling was conducted from 0 to 35 m downstream of the bridge. A sandbar in the middle of this reach divided Snipe Hollow Creek into two riffle/runs for a distance of 15 m; the creek then became a slower flowing pool/run. Width of the riffle/runs varied from 1 to 2.5 m; width of the creek downstream of the gravel bar measured 6.3 m. Depth in both of the riffle/runs and the downstream pool/run averaged 0.85 m. The substrate of Snipe Hollow Creek was primarily gravel with some areas of sand and pieces of cobble; small mud/silt areas were also present. Turbidity was moderate. Surrounding land use upstream of the bridge included a fallow field and corn; downstream, the creek was shaded along one side by a wooded bluff, and on the other side by a mowed hay field. Surveys for fishes and mussels were conducted on 27 June 1995.

Site 5A. The Apple River 2.5 mi NNE Hanover was surveyed for fishes and mussels on 28 June 1995. A 30 m stretch of the Apple River bisected by the old Chicago and Northwestern Railroad bridge alignment (dismantled) was sampled. River width varied from 12 to 15 m; depth varied between 1 and 2 m. Substrate in this reach of the Apple River was mud. Stream banks were steep and sparsely vegetated. Turbidity was high. The surrounding land use was agriculture. Surveys for aquatic macroinvertebrates (other than mussels) and sampling for water quality were not conducted at this site.

FISHES

BACKGROUND

All sites sampled in the FAP 301 project area (Wetzel et al. 1995) are mainstems or tributaries of three major drainages; Galena, Apple, and Pecatonica River drainages; none of the five sites in the Addendum #1 corridor, however, occurs in the Pecatonica River drainage. While the fish fauna of this area is not as well documented as other drainages in Illinois, over 75 known collections from 60 sites exist in the INHS Fish Collection. A total of 89 fish species in 15 families are known from these three river systems. Two state endangered and three state threatened species are known from the Apple and Pecatonica drainages. No state listed species are known to occur in the Galena River drainage. The following summary of species of special concern known from the entire FAP 301 project was previously presented in Wetzel et al. (1995).

Endangered and Threatened Fishes in the FAP 301 Project Area

The state threatened Iowa darter, *Etheostoma exile*, is known from 4 locations in the Pecatonica River drainage. The Iowa darter has been collected on four occasions from two sites in North Branch Otter Creek in extreme northeast Stephenson and northwestern Winnebago counties, dating from 1963 to 1971. On 23 June 1963, 19 individuals were collected from the Pecatonica River at Pecatonica, Winnebago County. Single specimens were also collected from Raccoon Creek in north-central Winnebago County on two dates, 23 June 1976 and 24 May 1990.

The state threatened blackchin shiner, *Notropis heterodon*, is known from a single locality, the Pecatonica River at Freeport, Stephenson County. This record dates 4 May 1880.

The state threatened blacknose shiner, *Notropis heterolepis*, is also known from a single locality, the Apple River, Jo Daviess County. Since this record dates 27 August 1901, a more precise location is unavailable.

The state endangered western sand darter, *Etheostoma clarum*, known only from the Sugar River, 4 mi NW Shirland, in northwestern Winnebago County. This single record dates 17 August 1968.

METHODS (Fishes)

Fishes were collected from the five Addendum #1 sites on 27 and 28 June 1995 by INHS personnel K. S. Cummings, S. L. Johnson, and C. A. Taylor using a standard 10 x 5 foot, 3/16 inch mesh minnow seine. Voucher specimens of each species collected were preserved in field with 10% formalin and returned for deposition in INHS Fish Collection. Relative abundance values were determined in the field using the following criteria:

less than 5 individuals collected = uncommon

5 to 10 individuals collected = common

greater than 10 individuals collected = abundant

RESULTS

Five sites within the FAP 301 Addendum #1 project area were sampled for fishes in June 1995, resulting in the collection of 17 species in 5 families (Table 2). No species listed at the federal or state level as endangered or threatened were collected or observed at any of the five sampling sites.

The Ozark minnow (*Notropis nubilus*), an Illinois Watch List species, was collected at site 1A (East Branch Galena River, 3 mi NE Galena).

DISCUSSION

Of the five listed fish species of special concern discussed in the "Background" section of this report, only two are known to historically occur in the immediate vicinity of the proposed Addendum #1 project corridor. Because the record for the blacknose shiner from the Apple River in Jo Daviess County dates 27 August 1901 and the record for the weed shiner from Yellow Creek in Stephenson County dates 5 May 1880, we believe, as previously stated in Wetzel et al. (1995), that it is highly unlikely that populations of these fishes persist in the Addendum #1 project area.

The Ozark minnow occurs commonly in the Galena and Apple River drainages of Illinois. In addition to the specimens collected at Site 1A, the species recently was collected at several other Galena River and Apple River sites in the FAP 301 project area (Wetzel et al. 1995). Preferred habitat of the Ozark minnow, clear fast creeks with gravel bottoms (Smith 1979), occurs throughout upper portions of the Galena and Apple river drainages. Outside of the extreme northwestern part of the state, the species has been recorded from Illinois at only three other locations - all Mississippi River sites in southwestern Illinois. Restricted range and its affinity for clear, high quality streams are the most likely reasons for classification of the Ozark minnow as an Illinois Watch List species.

Table 2. Fishes collected by INHS personnel from the IDOT FAP 301 (U.S. Route 20) Addendum #1 (Snipe Hollow) project area, Jo Daviess County, Illinois, on 27 and 28 June 1995. Site 1A: East Branch Galena River; Site 2A: Smallpox Creek; Site 3A: unnamed tributary of Smallpox Creek; Site 4A: Snipe Hollow Creek; Site 5A: Apple River. The legal locations of these sites are included in the "Project Location" section of this report. See the "Methods" section of this report for criteria used to determine relative abundance values. "U" = uncommon, "C" = common, "A" = abundant, "-" = not present.

Species	Relative Abundance				
	site 1A	site 2A	site 3A	site 4A	site 5A
CYPRINIDAE					
Campostoma anomalum	C	A	A	C	-
Luxilus cornutus	A	-	-	A	-
Nocomis biguttatus	A	-	-	-	-
Notropis atherinoides	U	-	–	–	–
N. buchanani	-	-	-	-	U
N. nubilus [WL]	C	-	-	-	-
Phoxinus erythrogaster	-	A	A	U	-
Pimephales notatus	A	-	-	-	C
Rhinichthys atratulus	-	-	-	U	-
Semotilus atromaculatus	-	A	A	A	-
CATOSTOMIDAE					
Catostomus commersoni	A	A	C	U	-
ICTALURIDAE					
Noturus gyrinus	U	-	-	-	-
CENTRARCHIDAE					
Lepomis cyanellus	-	-	-	-	U
L. macrochirus	-	-	-	U	U
Micropterus dolomieu	C	-	-	-	-
PERCIDAE					
Etheostoma flabellare	A	-	A	A	-
E. nigrum	A	A	A	A	-
Total number of species	11	5	6	9	4

[WL] indicates Illinois Watch List species

MUSSELS

BACKGROUND

Very little information is available on mussels from the FAP 301 (U.S. Route 20) study corridor (Apple and Galena rivers, Rush and Smallpox creeks, and tributaries of the Pecatonica River) from the literature or from museum collections. The oldest collection of mussels in the Galena River watershed represented in a museum collection was from below the mouth of the East Fork of the Galena River, where a single specimen of the state endangered slippershell, *Alasmidonta viridis*, was collected in 1941 (USNM [Smithsonian Institution] 518796). No other mussel species were found associated with this specimen. A survey of the Galena River in the vicinity of the North Council Hill Road bridge (8.9 km NNE Galena) by INHS personnel M. J. Wetzel, P. A. Ceas. A. E. Boerger, and B. J. Kasprowicz on 12 July 1989 yielded neither live mussels nor dead or subfossil shell material. There are no other reports of historical or recent surveys for mussels in the Galena River or its tributaries.

There are no historical or recent collection records of mussels from the Apple River or its tributaries in the FAP 301 project corridor. Although surveys for mussels have been conducted at several Apple River localities outside of the FAP 301 project corridor by INHS personnel within the last few years, none have yielded live mussels, even in areas that appeared to contain favorable mussel habitat. These surveys are summarized below.

A mussel survey of the Apple River in the vicinity of the East Canyon Road bridge in Apple River Canyon State Park (7 mi NNW Stockton) by INHS personnel Wetzel, Ceas, Boerger, and Kasprowicz on 12 July 1989 yielded neither live mussels nor dead or subfossil shell material.

The Apple River in the vicinity of the IDOT FAS 73 (Scout Camp Road) bridge, located 4 mi N of Woodbine, was surveyed for mussels using both SCUBA and wading methodologies by INHS personnel on 17 and 18 December 1990. No evidence of mussels was observed during that survey; neither live specimens nor dead shells or shell fragments were found either in the water or along the river banks (memorandum to Dr. George Rose, IDOT, from J. M. Berlocher, INHS, dated 9 January 1991).

On 22 July 1991, INHS personnel Ceas and Berlocher conducted surveys for mussels at two sites located in Apple River Canyon State Park, 3.5 mi SW Warren – 1) the Apple River in the vicinity of the East Canyon Park Road (IDOT FAS 74: 1BR) bridge, and 2) the South Fork of the Apple River at Canyon Road (IDOT FAS 74: 1BR-1) bridge. No evidence of mussels was observed during those surveys; neither live specimens nor dead shells or shell fragments were found in the area examined at either site (memorandum to Dr. Cassandra Rodgers, IDOT District 2, from J. M. Berlocher, INHS, dated 16 September 1991).

Surveys for mussels of the Apple River in the vicinity of the South Grebner Road (IDOT TR 138A) bridge (3 mi NE Elizabeth) were conducted by INHS personnel Berlocher, Ceas, and Wetzel on 11 May 1992 (memorandum to Mr. Gary Gould and Dr. George Rose, IDOT, from Ceas, Berlocher, and Wetzel, dated 27 May 1992, emended 12 June 1992). During that survey, no live mussels were found, but one relatively fresh dead shell of *Pyganodon* (as *Anodonta*) *grandis* was collected from the shore. A few subfossil shells of *Lampsilis siliquoidea* and the state threatened species *Elliptio dilatata* also were collected on that date (Table 3).

On 11 May 1992, Berlocher, Ceas, and Wetzel also surveyed a site on Mill Creek (a tributary of the Apple River), located 0.9 mi [1.4 km) N of the South Grebner Road site; live individuals of *Pyganodon* (as *Anodonta*) *grandis* were observed (this information also noted in the memorandum

cited in paragraph above; exact number of individuals not documented) and specimens of *Anodontoides ferussacianus* were collected as weathered dead shell (Table 3).

Surveys for fishes and mussels in two other Jo Daviess County streams – 1) the Menominee River in the vicinity of a county road bridge located 10 mi NW Galena (0.4 mi south of the Illinois / Wisconsin state line), and 2) the Sinsinawa River in the vicinity of the U.S. Route 20 (westbound lane) bridge located (4.4 mi NW Galena) – were conducted by INHS personnel Wetzel, Ceas, Boerger, and Kasprowicz on 12 July 1989; neither survey yielded either live mussels or dead or subfossil shell material (memorandum to Dr. Charles Perino, IDOT, from P. A. Ceas, J. M. Berlocher, and M. J. Wetzel, INHS, dated 19 February 1990).

There are no collection records for the tributaries of the Pecatonica River in the FAP 301 project corridor, but there is one record for *Lasmigona complanata* from Yellow Creek, collected at a location outside the study corridor near Freeport in Stephenson County (INHS Mollusk Collection).

There are no collection records for the tributaries of the Pecatonica River in the FAP 301 project corridor. Museum records are available for 15 species of mussels from surveys conducted outside the project corridor in the mainstem Pecatonica River (Table 3). These records include four live collections of the state threatened species, *Elliptio dilatata*, as well as the collection of live *Venustaconcha ellipsiformis*, a species on the Illinois Watch List.

During their recent surveys at 19 sites in the FAP 301 project area, INHS personnel collected evidence of unionid mussels from only eight of the sites. Thirteen species of unionid mussels were collected, but only five species were represented by live individuals (Wetzel et al. 1995).

Endangered and Threatened Mussels in the FAP 301 Project Area

Two state listed mussels have been reported from watersheds in the FAP 301 project area. The state endangered *Alasmidonta viridis* was collected in 1941 from the Galena River below the mouth of the East Fork Galena River in Jo Daviess County (INHS Mollusk Collection). Although no other records for this species are reported from the Galena River, its tributaries, or any other drainages in the project corridor, *A. viridis* may be more widespread than records indicate since few, if any, surveys have been conducted in these drainages.

Subfossil shells of *Elliptio dilatata*, a state threatened species, were collected by INHS personnel on 11 May 1992 from the Apple River in the vicinity of the South Grebner Road bridge in Jo Daviess County (memorandum to Mr. Gary Gould and Dr. George Rose, IDOT, from INHS personnel Ceas, Berlocher, and Wetzel, dated 27 May 1992, emended 12 June 1992). *Elliptio dilatata* has also been reported from four sites in the Pecatonica River in the 1950's (INHS Mollusk Collection). All four of those records are from sites outside of the FAP 301 project corridor.

Additional federal and state listed mussels have been reported from the Mississippi River adjacent to Jo Daviess County (INHS Mollusk Collection), including *Lampsilis higginsi*, a federally endangered species, *Plethobasus cyphyus*, a state endangered species, and *Ellipsaria lineolata, Elliptio crassidens, Elliptio dilatata,* and *Fusconaia ebena*, all state threatened species. Four of the drainages in the FAP 301 project corridor are direct tributaries of the Mississippi River and could support mussel species found in the larger river system; these tributaries include the Apple and Galena rivers and Smallpox and Rush creeks. *Elliptio dilatata* is the only species that has been reported from both the Mississippi River and one of the streams in the project corridor, the Apple River. None of the other special status mussels listed (above) as occurring in the Mississippi River have been collected from its tributaries in Jo Daviess County.

Table 3. Species of unionid mussels reported from historic and recent surveys in the Apple, Galena, Pecatonica, Rush, and Smallpox watersheds in Jo Daviess and Stephenson counties in Illinois (INHS Mollusk Collection). "L" indicates the species was collected live;"D" indicates species was reported as fresh dead shells; "WD" indicates species was reported as weathered dead shells; "SF" indicates species was reported as subfossil shells; "-" indicates no specimens of that species were found.

Species	Galena Drainage	Apple Drainage		Pecatonica Drainage	
	Galena River	Apple River	Mill Creek	Pecatonica* River	Yellow Creek
ANODONTINAE					
Alasmidonta viridis SE	SF	-	-	-	-
Anodontoides ferussacianus	-	D	WD	-	D
Lasmigona complanata	-	-	-	L	D
Lasmigona compressa	-	D	-	-	-
Pyganodon grandis	D	D	L	L	L
Strophitus undulatus	SF	L	-	L	WD
AMBLEMINAE					
Amblema plicata	-	WD	-	L	D
Elliptio dilatata ST	WD	WD	-	L	-
Fusconaia flava	WD	D	-	L	-
Pleurobema coccineum	-	-	-	L	-
Quadrula pustulosa	-	-	-	L	WD
Tritogonia verrucosa	-	-	-	L	-
LAMPSILINAE					
Actinonaias ligamentina	-	-	-	L	WD
Lampsilis cardium	L	WD	-	L	WD
Lampsilis siliquoidea	-	WD	-	L	WD
Lampsilis teres	-	-	-	L	-
Leptodea fragilis	-	L	-	-	-
Ligumia recta	-	-	-	L	WD
Toxolasma parvus	-	D	-	-	L
Venustaconcha ellipsiformis WL	-	-	-	L	L
Total number of species	6	11	2	15	12
Number of live species	1	2	1	15	3

SE indicates State Endangered species
ST indicates State Threatened species
WL indicates Illinois Watch List species
* Collection made in the 1950's

The following are species descriptions for endangered or threatened mussels reported from the Apple, Galena, Pecatonica, Rush, and Smallpox watersheds in Jo Daviess and Stephenson counties, Illinois.

Alasmidonta viridis - State Endangered

In Illinois, the slipper shell (*Alasmidonta viridis*) usually occurs in creeks and small streams in the northern and central parts of the state (Parmalee 1967). During a state-wide survey of mussels in Illinois, M. R. Matteson of the University of Illinois collected *A. viridis* only from the West Branch of the DuPage River and the Sangamon River system (INHS Mollusk Collection). Parmalee (1967) reported this species as locally abundant in Panther Creek of the Mackinaw River system, but surveys conducted in 1984 and 1985 by Kasprowicz and Wetzel (1986) revealed only worn shells and no live *Alasmidonta viridis* from any sites in Panther Creek or associated tributaries. Within the past 10 years, *A. viridis* has been found in a number of creeks and headwater streams in Illinois, including the upper Sangamon River, and tributaries of the Kankakee, Middle Fork Vermilion, and the Little Vermilion rivers (INHS Mollusk Collection). *Alasmidonta viridis* may be more common than present records indicate, but thorough collecting in its preferred habitat of shallow water over sand-gravel bottoms in creeks and small streams (Parmalee 1967) will be necessary to better assess its status in Illinois.

Elliptio dilatata - State Threatened

Elliptio dilatata formerly was common and locally abundant throughout the major river systems in Illinois (Danglade 1914; Baker 1926; van der Schalie and van der Schalie 1950). This species is occasionally collected live from the Kankakee and Mississippi rivers (Fuller 1978; Suloway 1981), but is now rare in most streams in Illinois (Cummings et al. 1988; Schanzle and Cummings 1991). The decline of this species appears most evident in large rivers such as the Rock and the Wabash, where large numbers of dead shells, but few, if any, live individuals can be found (Miller 1972; Cummings et al. 1988). *Elliptio dilatata* occurs in both large and small streams, typically in riffles in shallow water, or in deeper water (2 m or more) in strong current (Parmalee 1967).

METHODS (Mussels)

Sampling for mussels was conducted at the five Addendum #1 sites on 27 and 28 June 1995 by INHS personnel K. S. Cummings, S. L. Johnson, and C. A. Taylor by wading and visually looking for mussels or shell material as well as feeling the substrate by hand. Streambanks, islands, and other features were also searched for mussel shells and muskrat middens. Collector effort varied by site and depended on diversity of habitat and stream features present. A minimum of one collector-hour was spent at small tributaries with fairly uniform habitat; two to three collector-hours were spent at larger shallow sites with a diversity of features and habitat types. Voucher specimens for each species were deposited in the INHS Mollusk Collection.

RESULTS (Mussels)

No live mussels were found at any of the five Addendum #1 sites in June 1995. Only one weathered dead shell of *Pyganodon grandis* was found, at Site 5A. This Apple River site was the only one of the five Addendum #1 sites that contained shell material of any mussel species.

Two species of mussels were collected in 1993-1994 from two Smallpox Creek sites (Sites 4 and 5, in Wetzel et al. 1995); these are located near Addendum #1 Sites 2A and 3A. During that study, seven live *Pyganodon grandis* and six live *Toxolasma parvus* were found upstream of the U.S. Route 20 bridge (Site 4). Four live *T. parvus* were collected from a riffle located immediately upstream of the U.S. Route 20 bridge on 4 August 1993; and one of the *P. grandis* and two other

T. parvus were collected in a reach upstream of that riffle. Between 4 August and a second survey of that site on 23 September 1993, a beaver dam was constructed at this riffle, significantly modifying the habitat. Subsequent to its construction, six live *P. grandis* were collected from the vicinity of that beaver dam, in September 1993. One dead *P. grandis* and two dead *T. parvus* were found during a 20 April 1994 survey of this site. No other species were found live or represented by dead shell at Site 4 (Wetzel et al. 1995).

Further upstream on Smallpox Creek, Wetzel et al. (1995: Site 5) collected *Pyganodon grandis* and *Toxolasma parvus* were as fresh dead shell from muskrat middens along the base of the bluffs. The substrate in this area was dominated by bedrock outcrops which may have limited substrate availability for mussels. No other species were found live or represented by dead shell at this site.

DISCUSSION (Mussels)

No live mussels were found at any of the five Addendum #1 study sites in 1995 and only one weathered dead shell of *Pyganodon grandis* was found in the Apple River (Site 5A). No other sites surveyed during this present survey for mussels in the Addendum #1 project corridor contained live mussels or shell material of any federal or state endangered or threatened species.

No specimens of the state endangered slippershell, *Alasmidonta viridis*, were collected during the present survey in the Addendum #1 project corridor. Subfossil specimens of *A. viridis* were found in 1993-94 at the same locality from which this species had been collected in 1941 (Wetzel et al. 1995). It does not appear that a viable population of *A. viridis* presently occurs in the section of the Galena River surveyed for this project. Although several locations sampled during this study included small creeks with shallow water over sand and gravel - the habitat preferred by this species - no live individuals or shell material of *A. viridis* were found.

Elliptio dilatata, a state threatened species, was also represented only by subfossil shells collected from the Galena River during recent surveys of the FAP 301 project corridor in 1993-1994 (Wetzel et al. 1995: Site 1). Although this species had been reported previously from the Apple River drainage, no live or fresh dead shell material of *E. dilatata* was collected from the Apple River or from any other site in either the FAP 301 project corridor (Wetzel et al. 1995) or the Addendum #1 project corridor surveyed during this present study. This species appears to be declining throughout its range, with only shell material, and no live individuals, observed during many other river surveys in Illinois.

The Galena, Apple, Pecatonica, Rush, and Smallpox watersheds in and adjacent to the FAP 301 project corridor have not been extensively surveyed for the presence of unionid mussels, either historically or in recent times. To date, 33 sites have been surveyed; few have held evidence of mussels, and even fewer have yielded live specimens.

Limited survey effort is a significant factor in the lack of information on the occurrence of mussels, especially endangered or threatened species, in the FAP 301 project area. *Alasmidonta viridis* was reported historically in the Galena River and it appears that *Elliptio dilatata* also occurred historically at this same site.

Based on the paucity of live mussels observed during recent surveys for mussels at 19 sites in the FAP 301 project corridor (Wetzel et al. 1995) and at five sites in the present Addendum #1 corridor, and the lack of fresh shell for these two species, it is doubtful that either *A. viridis* or *E. dilatata* would occur there. None of the five sites surveyed during this present study in the Addendum #1 corridor contained live mussels or shell material of any federal or state endangered or threatened species, and it is unlikely that any federal or state endangered or threatened species presently occurs anywhere in either corridor.

OTHER AQUATIC MACROINVERTEBRATES

BACKGROUND

Biological assessments of streams based on tolerance of aquatic macroinvertebrates, using Illinois Environmental Protection Agency [IEPA] assessment methods, were conducted in the region by Brigham (1977, 1978). Each site was given one of four classifications (best to worst): balanced (B); unbalanced (UB); semi-polluted (SP); and polluted (P). Brigham's sites that coincided with or were located near those of the recent survey of 19 aquatic sites in the FAP 301 (U.S. Route 20) project corridor, and their respective classifications (abbreviations defined as above), are presented Wetzel et al. (1995). The IEPA no longer uses these methods and there is currently no biological assessment method based on macroinvertebrates in wide use in Illinois. The IEPA is currently working on revising data for a macroinvertebrate biotic index.

Over 140 taxa of aquatic macroinvertebrates were collected during those recent surveys of 19 stream sites in the FAP 301 (U.S. Route 20) project corridor (Wetzel et al. 1995). The collection of many of those species from Jo Daviess and Stephenson counties represented new county records. Several species identified during that study were either previously unknown from the state or were known from only a few collections; these included *Amphiagrion saucium* (Odonata), *Hesperocorixa atopodonta* (Hemiptera), and *Saldula opacula* (Hemiptera). Their presence in Jo Daviess and/or Stephenson counties is not too surprising given the proximity of areas in adjoining states from which they are known.

One hundred twenty-eight taxa of aquatic macroinvertebrates were collected during the present survey of four stream sites in the Addendum #1 project corridor (Table 4). Of these, several had not been collected previously from the 19 sites in the FAP 301 project area surveyed in 1993 and 1994 (Wetzel et al. 1995). Their presence during this study is a reflection on collecting effort, time of year when collections were taken, and available habitat; none of these should be considered unique to the area other than the caddisfly *Homoplectron doringa* (see information is species, below).

Endangered and Threatened Aquatic Macroinvertebrates in the FAP 301 Project Area

There is one state endangered amphipod species known from the region. *Stygobromus iowae* Hubricht is known from one specimen, collected from an algific slope in an abandoned mine in Jo Daviess County in 1965 (Holsinger 1972; Herkert 1992). This only known locality in Illinois is along the Mississippi River, west of the IDOT FAP 301 and Addendum #1 project corridors.

No federal or state listed endangered or threatened species of aquatic macroinvertebrates are known to occur in the FAP 301 or Addendum #1 project corridors.

METHODS (Aquatic Macroinvertebrates)

Macroinvertebrates other than unionid mussels were collected with a dip net in all accessible habitats, and by hand picking of large rocks, logs, leaf packets, and other available substrates. Additionally, adult Odonata were collected with an aerial net. Macroinvertebrate samples were fixed in the field with buffered formalin or preserved in alcohol and then returned to the laboratory for processing. Samples were processed under a 10x dissecting microscope; macroinvertebrates were identified and sorted to taxon. Several groups were sent to experts for species identification. After identification, all specimens were deposited in the INHS Collections in Champaign.

RESULTS (Aquatic Macroinvertebrates)

Aquatic macroinvertebrate taxa richness over the four Addendum #1 sites was moderate. Sensitive taxa, measured as the total of Ephemeroptera + Plecoptera + Trichoptera taxa (EPT), was also moderate across three of four sites (Table 4). Aquatic biologists have rated the ability of macroinvertebrates to tolerate disturbances from nonpoint and point sources of pollution (Brigham 1977, 1978; Hite and Bertrand 1989; Plafkin et al. 1989). Intolerant taxa do not tolerate disturbance (sewage, silt inputs), facultative organisms live under a variety of conditions but tend to be more abundant in disturbed streams, and tolerant species are those that are most abundant in degraded (highly polluted, silted) environments. The six numerically dominant taxa at each site were determined and a tolerance ratings given to them. Nearly all dominant taxa were considered facultative or tolerant of disturbance (Table 5).

East Fork Galena River. EFGR had the highest total taxa richness and a moderate EPT index. Facultatively classed taxa were dominant, especially the riffle beetle *Stenelmis* prob. *crenata* and the chironomid *Polypedilum convictum* group. Both can be abundant in moderately degraded systems. The latter is referred to as a "blood worm" due to its red respiratory pigment that helps it gather oxygen while living in sediments. This is particularly advantageous in sediment waters that may be low in dissolved oxygen. High organic loads (from livestock drainage) could produce this. Cattle are common in this drainage.

Smallpox Creek. Facultative and tolerant organisms were dominant here (Table 5). The abundance of *P. convictum* group and the sowbug *Caecidotea intermedia* indicate that this site has been moderately impacted by nutrient enrichment

Unnamed tributary to Smallpox Creek. This site is also moderately degraded based on the dominance of the blood worms *P. convictum* group and *Microtendipes pedellus* group (Table 5). One notable find was that of several adults of the caddisfly, *Homoplectron doringa*, that Ross (1944) had reported (as *Aphropsyche aprilis*) from a single locality in southern Illinois. It has been reported from small streams in the Ozark Plateau (Moulton and Stewart 1996).

Snipe Hollow Creek. Sensitive taxa (EPT) were conspicuously lacking at this site. The dominance by *P. convictum* group, *Phaenopsectra obediens* group, and *C. intermedia* (Table 5) indicate a moderately degraded system.

DISCUSSION (Aquatic Macroinvertebrates)

Brigham (1977, 1978) collected extensive macroinvertebrate samples from the Mississippi River drainages of northwestern Illinois during July 1976. She found that most streams in the region were "unbalanced" or "semi-polluted." Much of this degradation was attributed to municipal and industrial point sources of pollution and to the prevalent nonpoint sources such as runoff from row crops and livestock drainage in the basins. All basins discussed in this report were sampled during the Brigham study. Table 6 summarizes water quality designations given for the Brigham sites surveyed in Jo Daviess County. Sample site numbers increase in an upstream direction.

Comparison of the two studies suggests that none of these drainages offer unique resources. The few possible county records for some macroinvertebrate taxa reflect the relative paucity of collection effort in the northwest corner of Illinois, not significant findings.

Table 4. Aquatic macroinvertebrate taxa identified from June 1995 collections taken from streams in the FAP 301 (U.S. Route 20 Addendum #1 project corridor, Jo Daviess County, Illinois. EFGR = East Fork Galena River (1A), SPX = Smallpox Creek (2A), utSPX = unnamed tributary Smallpox Creek (3A), SHC = Snipe Hollow Creek (4A).

	Sites			
Taxon	EFGR	SPX	utSPX	SHC
Turbellaria (Unsegmented worms)				
Planariidae (Flatworms) indeterminate		X	X	X
Nematoda (Round worms)		X		X
Annelida (Segmented worms)				
Branchiobdellida (Crayfish worms) indeterminate	X		X	
Oligochaeta (Aquatic worms)				
Enchytraeidae indeterminate		X	X	X
Lumbricidae indeterminate	X	X		
Naididae				
Chaetogaster diaphanus Gruithuisen		X		
Dero digitata Müller		X		
Nais behningi Michaelsen			X	X
Nais bretscheri Michaelsen	X		X	X
Nais communis Piguet		X		
Nais pardalis Piguet	X			X
Nais variabilis Piguet	X	X		X
Nais sp.	X		X	
Paranais frici Hrabe	X			
Pristina leidyi Smith				X
Slavina appendiculata d'Udekem		X		
Tubificidae				
Aulodrilus pigueti Kowalewski	X			
Limnodrilus hoffmeisteri Claparède	X		X	X
Hirudinea (Leeches)				
Erpobdellidae				
Erpobdella punctata (Leidy)		X	X	
Erpobdellidae indeterminate	X	X		
Glossiphoniidae				
Helobdella stagnalis (Linnaeus)	X			X
Crustacea				
Ostracoda sp. (Seed shrimps)				X
Isopoda (Aquatic sowbugs)				
Asellidae				
Caecidotea intermedia (Forbes)		X		X
Caecidotea sp.	X			
Amphipoda (Scuds)				
Crangonyctidae				
Synurella? sp.		X		

(Table 4 continued on following page)

Table 4 (continued).

Taxon	Sites EFGR	SPX	utSPX	SHC
Gammaridae				
Gammarus fasciatus Say		X	X	X
Gammarus pseudolimnaeus Bousfield	X			
Gammarus sp.	X			
Talitridae				
Hyalella azteca (Saussure)	X	X		
Hydracarina spp. (Water mites)	X			X
Ephemeroptera (Mayflies)				
Baetidae				
Baetis brunneicolor McDunnough		X	X	X
Baetis flavistriga McDunnough	X	X	X	X
Baetis tricaudatus? Dodds		X		
Caenidae				
Caenis sp.	X	X		
Heptageniidae				
Stenacron gildersleevei Traver				X
Stenacron interpunctatum (Say)	X	X	X	
Stenonema femoratum (Say)		X	X	
Leptophlebiidae indeterminate		X		
Odonata (Dragon/Damselflies)				
Aeshnidae				
Aeshna tuberculifera Walker			X	
Calopterygidae				
Hetaerina americana (Fabricius)	X			X
Calopteryx maculata (Beauvois)	X		X	X
Coenagrionidae				
Enallagma sp.	X			
Plecoptera (Stoneflies)				
Perlidae				
Perlesta decipiens (Walsh)	X	X		X
Hemiptera (Aquatic true bugs)				
Corixidae				
Sigara sp.	X			X
Trichorixa calva (Say)				X
Gerridae				
Gerris marginatus Say		X		
Gerris remigis Say		X		X
Gerris sp.	X		X	
Trepobates sp.	X			
Veliidae				
Microvelia sp.	X	X		X

(Table 4 continued on following page)

Table 4 (continued).

Taxon	Sites EFGR	SPX	utSPX	SHC
Megaloptera (Dobson/Alderflies)				
Sialidae				
Sialis sp.	X			
Trichoptera (Caddisflies)				
Hydropsychidae				
Ceratopsyche alhedra? (Ross)	X			
Ceratopsyche morosa (Hagen)	X	X		
Ceratopsyche morosa group	X			
Ceratopsyche slossonae Banks	X	X	X	X
Cheumatopsyche sp.	X	X	X	
Homoplectron doringa (Milne)			X	
Hydropsyche betteni Ross	X			
Potamyia flava (Hagen)	X	X		
Hydroptilidae				
Hydroptila sp.	X	X	X	X
Ochrotrichia sp.			X	
Philoptamidae				
Chimarra feria Ross			X	
Polycentropodidae				
Cernotina sp.			X	
Coleoptera (Aquatic beetles)				
Dryopidae				
Helichus lithophilus (Germar)				X
Dytiscidae				
Agabus sp.	X	X	X	X
Hydroporus undulatus Say			X	
Laccophilus proximus Say	X			
Elmidae				
Dubiraphia brevipennis Hilsenhoff			X	
Dubiraphia parva Hilsenhoff	X			
Dubiraphia quadrinotata (Say)			X	X
Dubiraphia sp.	X		X	X
Optioservus fastiditus LeConte			X	
Optioservus sp.	X	X	X	X
Stenelmis crenata Say	X	X	X	X
Stenelmis sp.	X	X	X	X
Gyrinidae				
Gyrinus sp.	X			
Haliplidae				
Peltodytes duodecimpuntatus (Say)	X			
Peltodytes edentulus (LeConte)	X		X	
Peltodytes sp.	X			X

(Table 4 continued on following page)

Table 4 (continued).

Taxon	Sites EFGR	SPX	utSPX	SHC
Hydrophilidae				
Helophorus sp.	X	X		X
Paracymus confluens Wooldridge			X	
Tropisternus lateralis nimbatus (Say)				X
Diptera (True flies)				
Athericidae				
Atherix variegata Walker	X	X		X
Ceratopogonidae				
Bezzia complex	X	X		
Chironomidae				
Brillia flavifrons (Johannsen)				X
Chironomus sp.			X	X
Cladotanytarsus sp.				X
Cricotopus bicinctus (Meigen)	X			X
Cricotopus/Isocladius sp.	X	X	X	X
Cricotopus/Orthocladius sp.			X	X
Cricotopus trifascia Edwards	X	X	X	X
Cryptochironomus fulvus group	X	X	X	X
Cryptotendipes sp.	X	X	X	X
Dicrotendipes fumidus (Johannsen)		X	X	
Dicrotendipes neomodestus (Mallach)	X			
Eukiefferiella bavarica group	X	X	X	X
Eukiefferiella devonica group		X	X	X
Microtendipes pedellus group	X		X	X
Odontomesa sp.		X		X
Orthocladius annectens? Saether		X		
Parakiefferiella sp.				X
Parametriocnemus sp.		X	X	
Paratanytarsus sp.	X	X		
Paratendipes albimanus? (Meigen)	X	X	X	X
Phaenopsectra obediens group		X	X	X
Polypedilum convictum group	X	X	X	X
Polypedilum illinoense group			X	X
Rheocricotopus sp.				X
Rheotanytarsus sp.		X	X	X
Tanytarsus spp.	X	X	X	X
Thienemanniella sp.		X	X	X
Thienemannimyia group	X	X	X	
Tribelos sp.				X
Dixidae				
Dixa sp.			X	
Empididae				
Hemerodromia sp.				X

(Table 4 concluded on following page)

Table 4 (concluded).

Taxon	Sites EFGR	SPX	utSPX	SHC
Muscidae				
Limnophora sp.			X	
Simuliidae				
Simulium sp.		X		
Stratiomyidae				
Stratiomys sp.				X
Tabanidae				
Chrysops sp.			X	
Tabanus sp.	X			X
Tipulidae				
Antocha sp.	X			
Tipula sp.	X		X	
Mollusca				
Pelecypoda (Clams and mussels)				
Sphaeriidae				
Pisidium sp.	X	X		X
Sphaerium sp.	X			
Gastropoda (Snails)				
Lymnaeidae				
Fossaria sp.	X		X	
Pseudosuccinea columella	X			
Physidae				
Physa sp.		X	X	X
Physella sp.	X	X		X
Total Taxa	66	61	56	63
EPT Taxa	11	13	12	5
Midge Taxa	13	18	20	23

Table 5. Six most numerically dominant aquatic macroinvertebrate taxa found in June 1995 collections from streams in the IDOT FAP 301 (U.S. Route 20) Addendum #1 project corridor, Jo Daviess County, Illinois. EFGR = East Fork Galena River (1A), SPX = Smallpox Creek (2A), utSPX = unnamed tributary Smallpox Creek (3A), SHC = Snipe Hollow Creek (4A).

Taxon	EFGR	SPX	utSPX	SHC	Tolerance
Stenelmis prob. *crenata*	X		X		F
Polypedilum convictum group	X	X	X	X	T
Cryptotendipes sp.	X				F
Cricotopus bicinctus	X				T
Cricotopus/Isocladius sp.	X				F
Microtendipes pedellus group	X		X		F
Physa sp.		X			T
Gammarus fasciatus		X	X	X	F
Caecidotea intermedia		X		X	T
Cricotopus trifascia		X			F
Eukiefferiella bavarica group		X		X	I
Calopteryx maculata			X		F
Baetis flavistriga			X		F
Phaenopsectra obediens group				X	F
Chironomus sp.				X	T

Table 6. Water quality designations given for stream sites in Jo Daviess County, Illinois, surveyed by Brigham (1977).

Brigham Sites	Water Quality Designation	Explanation
EF Galena River		
MQB-10	semi-polluted	<10% individuals intolerant
EFGR-1A	**moderately degraded**	**preponderance of facultative / tolerant taxa**
MQB-11	unbalanced	10-50% intolerant
Smallpox Creek		
MPA-10	semi-polluted	
MPA-11	semi-polluted	
MPA-12	unbalance	
MPA-13	semi-polluted	
SPX-2A	**moderately degraded**	
utSPX-3A	**moderately degraded**	
Snipe Hollow Creek		
MNDB-10	unbalanced	
SHC-4A	**moderately degraded**	

No federal or state listed endangered or threatened species of aquatic macroinvertebrates, or species under consideration for such listing, were collected in the FAP 301 project corridor in Jo Daviess or Stephenson counties during the initial survey for aquatic resources in 1993 and 1994 (Wetzel et al. 1995) or during the surveys conducted at five Addendum #1 sites in June 1995.

AQUATIC MACROPHYTES

Diverse aquatic macrophyte communities are generally uncommon in lotic systems, particularly those in Illinois. During the course of our initial surveys of aquatic resources in the FAP 301 project corridor during 1993 and 1994, small colonies of aquatic macrophytes were encountered. Although not considered macrophytes, mats of one green alga and at least one blue-green alga also were encountered occasionally in the project corridor (Wetzel et al. 1995). No aquatic plants were observed during the present study of five sites in the Addendum #1 project corridor.

METHODS (Aquatic Macrophytes)

Aquatic macrophytes and algae, when encountered in the field, are placed in habitat water in plastic bags and then stored on ice in coolers until their return to the INHS Herbarium. No species, however, were encountered during this present study.

RESULTS AND DISCUSSION (Aquatic Macrophytes)

During recent surveys of aquatic resources in the FAP 301 (U.S. Route 20) project corridor, only three species of aquatic macrophytes were collected (Wetzel et al. 1995). These included curlyleaf pondweed (*Potamogeton crispus* Linnaeus), leafy pondweed (*Potamogeton foliosus* Rafinesque) (both Family Potamogetonaceae), and American elodea (*Elodea canadensis* Michaux) (Family Hydrocharitaceae); each of these species is commonly observed in stream systems in Illinois. All

three species were observed at Smallpox Creek (Site 4) during the August and September 1993 collections. *Elodea canadensis* also was collected from Yellow Creek at West Stees Road (Site 17) during the August 1993 survey. No aquatic macrophyte species, however, were encountered during the present study of five sites in the Addendum #1 project corridor.

The green alga, *Cladophora* cf. *glomerata* (Chlorophyta: Cladophoraceae), a common species in streams throughout Illinois, was observed in small patches periodically at several sites during the August and September 1993 collections described in Wetzel et al. (1995). During the August 1993 surveys, collections of *C. glomerata* were made at Site 18, a tributary of Yellow Creek at West Goddard Road bridge, and Site 19, a tributary of the Pecatonica River at Rink Road bridge. Colonies of filamentous blue-green algae (Cyanophyta) were observed periodically at several sites, most notably at Furnace Creek (Site 7) and its tributary in Long Hollow (Site 6) during the August and September 1993 and April 1994 surveys. Organic nutrients from a residential septic field and cattle barnyard runoff at Site 6 and from an extensive cattle pasture runoff area at Site 7 probably contributed to the extensive and recurring algal community at these two sites (Wetzel et al. 1995).

No *Cladophora* was observed at any of the five Addendum #1 sites in June 1995, although it is likely that this alga occurs at one or more sites periodically. Small patches of filamentous blue-green algae were present at Addendum #1 Site 1A (East Fork Galena River), Site 2A (Smallpox Creek), Site 3A (unnamed tributary Smallpox Creek), and Site 4A (Snipe Hollow Creek).

Endangered and Threatened Aquatic Macrophytes in the FAP 301 Project Area

No federal or state listed endangered or threatened species of aquatic or semi-aquatic plants, or species under consideration for such listing, were observed or are thought known to occur in streams in the FAP 301 (U.S. Route 20) project corridor in Jo Daviess and Stephenson counties (Wetzel et al. 1995) or the Addendum #1 project corridor in Jo Daviess County.

WATER QUALITY MONITORING

METHODS

Field Procedures. Ambient air and water temperatures were measured with either an electronic thermometer or a red liquid thermometer; dissolved oxygen was measured with a YSI Model 54 or 57 Dissolved Oxygen Meter; hydrogen ion concentration (as *p*H) was measured with an Orion model SA250 *p*H/mV/temperature meter; field conductivity was measured with a YSI Model 33 S-C-T Conductivity Meter; specific conductance (@ 25° C) was determined from a correction factor table; salinity was measured with a YSI Model 33 S-C-T Conductivity Meter. Water samples (500 ml) collected from each sampling site were placed on ice, and returned to the INHS and Illinois State Geological Survey (ISGS) water quality laboratories for analyses.

Laboratory Procedures. Dissolved oxygen (% saturation) was determined by calculation; hydrogen ion concentration (as *p*H) was measured with a Sargeant-Welch Model NX *p*H meter; total alkalinity was analyzed with a Mettler Titrator; turbidity was analyzed by a Cole Parmer Turbidimeter (in NTU); metals were analyzed by inductively coupled argon plasma spectroscopy utilizing a Jarrell Ash Model 1100 AtomComp system; chlorides, bromides, fluorides, sulfates, orthophosphate, nitrate nitrogen, and nitrite nitrogen were analyzed by ion chromatography utilizing a Dionex 2020i ion chromatograph with AG4A column and a Dionex conductivity detector; ammonia nitrogen, Kjeldahl nitrogen, and total nitrogen were analyzed by a Technicon AAII GT/pc chemical analysis system. Hardness (EDTA) was analyzed according to the American Public Health Association et al. [APHA] (1985). Additional technical information relating to the procedures and methodologies used for field and laboratory analyses of water samples can be obtained from APHA (1985).

RESULTS (Water Quality Montoring)

A complete list of the physical and chemical parameters that were measured and analyzed in the field as well as in the INHS and ISGS laboratories, and values resulting from those procedures, are provided in Appendix I.

DISCUSSION (Water Quality Montoring)

The responsibilities of INHS and ISGS personnel included the collection and analyses of water samples from aquatic sampling sites that were surveyed for fishes, mussels, other aquatic macroinvertebrates, and aquatic vegetation during the course of our study of the FAP 301 (U.S. Route 20) and Addendum #1 project corridors. Further interpretation of results and discussion of these water quality analyses will be provided by IDOT personnel and outside consultants to this project.

SUMMARY OF SURVEYS FOR AQUATIC RESOURCES IN THE IDOT FAP 301 (U.S. ROUTE 20) AND ADDENDUM #1 PROJECT CORRIDORS IN JO DAVIESS AND STEPHENSON COUNTIES, ILLINOIS

Fishes. During the present survey of 5 sites located in the Addendum #1 (Snipe Hollow) project corridor in Joe Daviess County, 17 species of fishes in 5 families were collected.

Thirty-four species of fishes representing 6 families were collected during recent surveys (1993-1994) of 19 sites in the FAP 301 (U.S. Route 20) project corridor (Wetzel et al. 1995). No significant temporal variations in fish faunas were observed at sites sampled repeatedly during that study. With the exception of the mud darter (*Etheostoma asprigens*), which was collected for the first time from Jo Daviess County, all species encountered during our surveys of streams in Jo Daviess and Stephenson counties had been known from historical records to occur in or near the FAP 301 project corridor (INHS Fish Collection).

No species of fishes listed at either the federal or state level as endangered or threatened were collected or observed during the course of recent surveys (1993-1994) of 19 sites in the FAP 301 project corridor (Wetzel et al. 1995), or during surveys of 5 sites in the Addendum #1 corridor in 1995. Of the two species of special concern that are historically known from the project area (see the "Discussion [Fishes]" section of Wetzel et al. 1995), we believe that it is highly unlikely that populations of either persist anywhere in the FAP 301 project corridor, including the Addendum #1 corridor. Given the last known dates of collection for these two species, both probably were extirpated from the region some time ago.

During this present study of five sites in the Addendum #1 project corridor, The Ozark minnow (*Notropis nubilus*), an Illinois Watch List species, was collected from Site 1A, the East Fork of the Galena River (3 mi NE Galena), in June 1995. Previously, the Ozark minnow was collected at four sites in the FAP 301 project corridor in 1993-1994 (Wetzel et al. 1995: Sites 1, 2, 9, and 10). The Ozark minnow occurs commonly in the Galena and Apple River drainages of Illinois. Preferred habitat of the Ozark minnow, clear fast creeks with gravel bottoms (Smith 1979), occurs through-out upper portions of the Galena and Apple river drainages. Outside of the extreme northwestern part of the state, the species has been recorded from Illinois at only three other locations - all Mississippi River sites in southwestern Illinois. Restricted range and its affinity for clear, high quality streams are the most likely reasons for classification of the Ozark minnow as an Illinois Watch List species.

Unionid mussels. No live mussels were collected during the present survey of 5 sites in the Addendum #1 project corridor in Jo Daviess County. Only one weathered dead shell of *Pyganodon grandis* was found, at Site 5A. This Apple River site was the only one of the five Addendum #1 sites that contained shell material of any mussel species.

Thirteen species of unionid mussels were collected during recent surveys (1993-1994) in the FAP 301 (U.S. Route 20) project corridor (Wetzel et al. 1995); only 5 of these, however, were collected alive. Although surveys for mussels have been conducted at 33 localities in the Apple, Galena, Pecatonica, Rush, and Smallpox watersheds in Jo Daviess and Stephenson counties, few have held evidence of mussels, and even fewer have yielded live specimens.

Of the 33 sites visited historically or in recent surveys, including those sites investigated during the present study of 5 sites in the Addendum #1 project corridor, live mussels were collected at only eight of these sites; five additional sites contained only shell material. The density and diversity of mussels in these watersheds is very low when compared to that known from other watersheds that are tributaries of the Mississippi River in Illinois. The depauperate mussel fauna of streams in the FAP 301 and Addendum #1 project areas may be a reflection of 1) degraded water conditions and lack of suitable substrate at some locations, or 2) past disturbances to the mussel fauna from which populations have not yet recovered, in areas which now appear to have suitable substrate and adequate water quality.

No federal or state listed endangered or threatened species of unionid mussels is presently known to occur in streams in either the IDOT FAP 301 or Addendum #1 project corridors. No live mussels or shell material of any listed species were observed during the course of our surveys.

Other Aquatic Macroinvertebrates. One hundred twenty-eight taxa of aquatic macroinvertebrates were collected during the present survey of four stream sites in the Addendum #1 project corridor (Table 4). Of these, several had not been collected previously from the 19 sites in the FAP 301 project area surveyed in 1993 and 1994 (Wetzel et al. 1995).

Over 140 taxa of aquatic macroinvertebrates were collected during our surveys in the FAP 301 (U.S. Route 20) project corridor during 1993-1994 (Wetzel et al. 1995). The collection of many of those species from Jo Daviess and Stephenson counties represented new county records. Several species identified during that study were either previously unknown from the state or were known from only a few collections; these included *Amphiagrion saucium* (Odonata), *Hesperocorixa atopodonta* (Hemiptera), and *Saldula opacula* (Hemiptera). Their presence in Jo Daviess and/or Stephenson counties was not too surprising given the proximity of areas in adjoining states from which they are known. No federal or state listed endangered or threatened species of aquatic macroinvertebrates are known to occur in the FAP 301 project corridor, and none of the listed species were observed during the course of our surveys.

Comparisons of the two studies suggest that none of these drainages offer unique resources. The few possible county records for some macroinvertebrate taxa reflect the relative paucity of collection effort in the northwest corner of Illinois, not significant findings.

Aquatic Macrophytes. Three species of aquatic macrophytes were collected during the 1993-1994 surveys for aquatic resources in the FAP 301 (U.S. Route 20) project corridor (Wetzel et al. 1995); each of those species is widely distributed and commonly observed in stream systems in Illinois. No aquatic macrophyte species were collected from any of the 5 Addendum #1 sites, however. A green alga (*Cladophora* cf. *glomerata*) and blue-green algae were observed periodically at several sites in the FAP 301 project corridor during 1993 and 1994 (Wetzel et al. 1995).

No federal or state listed endangered or threatened species of aquatic macrophytes are known to occur in the FAP 301 project corridor, and none of the listed species were observed during the course of our surveys in the Addendum #1 project corridor.

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APPENDIX 1.

Water quality analyses completed on samples collected from streams located in the IDOT FAP 301 (U.S. Route 20) Addendum #1 project corridor, Jo Daviess County, Illinois. June 1995.

APPENDIX 1. Water quality analyses completed on samples collected from streams located in the IDOT FAP 301 (U.S. Route 20) Addendum #1 project corridor, Jo Daviess County, Illinois. - JUNE 1995 -	Water Body	East Fork Galena River	Smallpox Creek	unnamed tributary Smallpox Creek	Snipe Hollow Creek
	Location	WSW Council Station, N of W Kelly Rd.	NNE Hanover, at Rawlins Rd. br.	SSW Scales Mound, at W Guilford Rd. br.	S of Council Hill Station, at Snipe Hollow Rd. br.
	Site #	1A - EFGR	2A - SPX	3A - utSPX	4A - SHC
	Sample Date	21 June 1995	21 June 1995	22 June 1995	22 June 1995
PARAMETERS *	**Standard****				
Field Measurements					
Ambient Air Temperature (° C)	-	35.5	35	34	28
Water Temperature (° C)	-	28	28	22	19.5
Dissolved Oxygen	never < 5.0	10.6	9.6	9.1	10.6
Hydrogen Ion Concentration (pH)	6.5 to 9.0	8.58	8.45	8.41	8.32
Alkalinity, as CaCO3 [1]	-	300	271	317	316
Field Conductivity (µmhos/cm)		700	700	700	670
Specific Conductivity (µmhos/cm)	-	657	657	740	745
(corrected to 25° C)					
Laboratory Measurements					
Total Organic Carbon	-	-	-	-	-
Inorganic Dissolved Carbon [0.1]		68.4	62.5	72.4	72.7
Dissolved Organic Carbon [0.1]		76.1	65.7	74.9	67
Total Dissolved Carbon [0.1]		144.5	128.2	147.3	139.7
Sulfur as Sulfate [0.01]	500.	54.9	31.1	34.4	24.7
Total Bromide [0.01]	-	-	-	-	-
Ammonia Nitrogen [0.01]	1.5 **	0.04	0.03	0.03	0.05
Nitrite Nitrogen [0.01]	-	0.10	0.10	0.08	0.07
Nitrate Nitrogen [0.01]	-	3.83	1.71	0.57	1.92
Total Phosphorus [0.01]		0.05	0.03	<DL	<DL
Hardness (EDTA) [1]	*	378	344	392	380
Chlorides [0.1]	500.00	16.3	9.93	5.21	7.14
Total Kjeldahl Nitrogen	-	-	-	-	-
Total Dissolved Solids [4]	1000.	428	404	448	428
Turbidity (NTU)	-	1	2	1	1
Dissolved Aluminum [0.02]	-	<0.02	<0.02	<0.02	<0.02
Dissolved Arsenic [0.1]	1.0	<0.1	<0.1	<0.1	<0.1
Dissolved Boron [0.02]	1.0	<0.02	0.03	0.04	<0.02
Dissolved Barium [0.005]	5.0	0.08	0.09	0.11	0.09
Dissolved Beryllium [0.001]	-	<0.002	<0.002	<0.002	<0.002
Dissolved Calcium [0.005]	-	73.8	65.1	78.8	75.5
Dissolved Cadmium [0.01]	0.05	<0.01	<0.01	<0.01	<0.01
Dissolved Cobalt [0.01]	-	<0.01	<0.01	<0.01	<0.01
Dissolved Chromium [0.01]	**	<0.01	<0.01	<0.01	<0.01
Dissolved Copper [0.01]	0.02	<0.01	<0.01	<0.01	<0.01
Dissolved Iron [0.01]	1.0	0.01	0.04	0.01	0.01
Dissolved Potassium [1.0]	-	<1	<1	<1	<1
Dissolved Lanthanum [0.002]	-	<0.002	<0.002	<0.002	<0.002
Dissolved Lithium [0.01]	-	<0.01	<0.01	<0.01	<0.01
Dissolved Magnesium [0.002]	-	47.1	44.1	47.3	46.4
Dissolved Manganese [0.01]	1.0	0.02	0.01	0.02	0.02
Dissolved Molybdenum [0.02]	-	<0.02	<0.02	<0.02	<0.02

(Appendix 1 concluded on following page)

APPENDIX 1 (concluded). Water quality analyses completed on samples collected from streams located in the IDOT FAP 301 (U.S. Route 20) Addendum #1 project corridor, Jo Daviess County, Illinois. - JUNE 1995 -	Water Body	East Fork Galena River	Smallpox Creek	unnamed tributary Smallpox Creek	Snipe Hollow Creek
	Location	WSW Council Station, N of W Kelly Rd.	NNE Hanover, at Rawlins Rd. br.	SSW Scales Mound, at W Guilford Rd. br.	S of Council Hill Station, at Snipe Hollow Rd. br.
	Site #	1A - EFGR	2A - SPX	3A - utSPX	4A - SHC
	Sample Date	21 June 1995	21 June 1995	22 June 1995	22 June 1995
PARAMETERS *	**Standard****				
Dissolved Sodium [0.05]	-	5.80	4.10	6.60	3.50
Dissolved Nickel [0.03]	1.0	<0.03	<0.03	<0.03	<0.03
Dissolved Lead [0.08]	0.1	<0.08	<0.08	<0.08	<0.08
Dissolved Antimony [0.1]	-	<0.1	<0.1	<0.1	<0.1
Dissolved Scandium [0.003]		<0.003	<0.003	<0.003	<0.003
Dissolved Selenium [0.1]	1.0	<0.1	<0.1	<0.1	<0.1
Dissolved Silicon [0.010]	-	4.81	5.02	5.62	4.58
Dissolved Strontium [0.01]	-	0.08	0.08	0.1	0.06
Dissolved Thallium [0.2]	-	<0.3	<0.3	<0.3	<0.3
Dissolved Titanium [0.01]	-	<0.01	<0.01	<0.01	<0.01
Dissolved Vanadium [0.01]	-	<0.01	<0.01	<0.01	<0.01
Dissolved Zinc [0.01]	1.0	0.14	0.19	0.19	0.21
Dissolved Zirconium [0.01]	-	<0.01	<0.01	<0.01	<0.01
Total Mercury [0.00005]	0.0005	<DL	<DL	<DL	<DL

* Unless otherwise specified, all measurements are expressed in milligrams per liter (mg/l).

** Surface water quality standards are taken from: Illinois Environmental Protection Agency. 1989. Title 35: Environmental Protection. Subtitle C: Water Pollution. Chapter I. Pollution Control Board. Part 302 - Water Quality Standards. Sections 302.201 through 302.212.

Ammonia Nitrogen and Un-ionized Ammonia: a) Ammonia nitrogen shall in no case exceed 15 mg/l; b) If ammonia nitrogen is less than 15 mg/l and greater than or equal to 1.5 mg/l, then un-ionized ammonia (as N) shall not exceed 0.04 mg mg/l; c) Ammonia nitrogen concentrations of less than 1.5 mg/l are lawful regardless of un-ionized ammonia concentration. [If total ammonia is >1.5 mg/l, then calculations must be made to determine the unionized ammonia concentration based upon *p*H and temperature.]

Phosphorus as P shall not exceed 0.05 mg/l in any reservoir or lake with a surface area of 8.1 hectares (20 acres) or more, or in any stream at the point where it enters any such reservoir or lake.

Although no current standard for total chromium has been established, the current standard for total hexavalent chromium is 0.05 mg/l; the current standard for total trivalent chromium is 1.0 mg/l; the sum of these two constituents would infer that the total chromium standard is 1.05 mg/l.